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basis of the merits of the case. The three grounds assigned evade the real issue of my views which was privately stated by the president to be the basis of his action. And this real issue, which is not frankly stated, but set aside by the interposition of an unjustifiable personal attack, is a violation of the principle of *Lehrfreiheit*.

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May 31, 1908

SPECIAL ARTICLES

A METHOD OF SENDING PURE CULTURES OF FUNGI

For several years the writer has had occasion to receive cultures of moulds from different parts of this country and from abroad and has learned to expect a large percentage of contaminations even when the cultures are pure when shipped. The usual method is to send a pure culture of the mould in a fresh slant tube of nutrient which has been hardened with either gelatin or agar. During transit the nutrient generally becomes shaken up against the cotton plug and there results an infection of bacteria or of moulds like *Penicillium* and *Aspergillus*, the spores of which are usually present on the outside of the cotton plugs but which germinate and grow down into the tubes when the plugs are wet or the surrounding air is rendered moist by rubber caps or even by paper wrappings which more or less completely seal the tubes. Recently the writer received a shipment of a considerable number of tubes from Utrecht, Holland, from the fungus collection of the Association Internationale des Botanistes. They were apparently fresh cultures and a very large proportion were thus irredeemable from contamination with weed fungi. It seems not undesirable, therefore, to describe in some detail a method of shipping cultures which experience has shown to be free from the objectionable features already mentioned, although it is a method which might naturally occur to any one having spores to send.

If cultures are to be sent in test-tubes it is advisable to avoid gelatin and to use rather stiffer agar than usual, which should be allowed to dry out and thus fasten itself against the

sides of the tubes before packing. For stock cultures, which are to be kept a year or so, the writer has successfully used as much as 30 and even 35 grams of agar to the liter, and agar of this degree of hardness might be used for shipping. While with proper precautions pure cultures may be sent in test-tubes yet the possibility of breakage or of infection already pointed out, as well as the possible inconvenience of custom-house inspection when packages are received from foreign correspondents, are objections to this method.

These disadvantages have led the writer to use small paper envelopes such as are made by druggists in putting up powders or by botanists in preserving fungi in exsiccati. A mass of the fungus filaments containing spores are taken with a sterilized instrument from a pure culture of the species desired, together with some of the substratum, and put into the envelopes, where it is allowed to dry. Several of these culture envelopes may be sent with little inconvenience in an ordinary letter. It has been the writer's practise as a matter of precaution to sterilize the envelopes either in an autoclav or in a dry oven at 140° C. before using them. The danger of infection is probably not very great if the culture envelopes, although unsterilized, are made up of clean paper that has not been unduly exposed to contamination since the few spores of *Penicillium* or other fungus weeds that may be present have little opportunity of germinating and spreading if the material used in the transfer be rapidly dried and kept in a dry condition. In making up the dry cultures it seems desirable to include some of the substratum mixed with the spores. In this way even such bacteria as *Bacillus prodigiosus* have been successfully sent through the mail and moulds have been received in good condition from as distant countries as the Philippines. Naturally with those fungi that fail to fruit well in captivity and to form spores or other reproductive bodies which retain their vitality, recourse must be had to test-tube cultures with hard agar. The envelope method has been used for several years by the writer and by several of his correspondents, and for the forms most generally cultivated seems to meet

all the requirements of convenience and freedom from contamination.

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BOTANICAL NOTES

SANE AND SCIENTIFIC FREE-SEED DISTRIBUTION

IN these days when we hear so much in very proper denunciation of the continuation of the congressional free-seed distribution which the United States Department of Agriculture is annually compelled to make, it is well to call attention to some work now quietly carried on by the Bureau of Plant Industry which is not only not open to such criticism, but, on the contrary, very much to be commended. Through inquiries made by a representative of SCIENCE the following authoritative statements have been elicited, and are here published in order to show the nature and scope of a legitimate seed and plant distribution, in contrast with the annual farce which is enacted at the imperious command of a majority of the congressmen. It is due the department to say that in these statements only a few of the lines of work conducted under the appropriations for "the purchase and distribution of valuable seeds" are mentioned.

FORAGE CROP WORK

Introduction and Extension of Alfalfa.—This work includes the extension of the present range of alfalfa culture in the east and the introduction of new varieties in the west. Special attention is being given to the development of varieties which will resist cold and drought, as well as varieties which will give greater yields than those ordinarily grown. Arabian alfalfa, secured by exploration in 1905, has proved to be by far the heaviest yielder in the southwest. Twelve cuttings were obtained at Mecca, Cal., during the past year as compared with eight cuttings of ordinary alfalfa. This is the most remarkable alfalfa yet found for rapidity of growth.

Propaganda Work with New and Standard Grasses.—This work has for its objects the wider utilization of the standard grasses and

the introduction and extension of the culture of new and improved varieties. Experiments with improved varieties of timothy, with meadow and pasture mixtures, and with several new grasses, such as Para grass, Guinea grass, and Natal grass, are being made. During the past year seed has been distributed of the two improved timothies developed by Dr. A. D. Hopkins, both of which possess very superior merit. One of these ripens with red clover and the other is a large yielder.

Cowpea Investigations.—The chief object of this work is to secure cheaper and better cowpea seed, so as to bring about a great increase in cowpea culture. The need is for good varieties producing small, hard seeds that will not crack and that retain their vitality for more than one year. The cowpea is to the south what clover is to the north, and the lessening of the cost of the seed and the improvement of varieties are important problems. Much attention is being given to the study and development of harvesting machinery.

Work with Vetches in the South.—This work consists of the introduction and encouragement of the growing of vetches throughout the south. The vetch is an exceedingly important plant and its much wider use is greatly to be desired. The development of varieties that will mature in time for cotton-planting, and the distribution of seed of desirable varieties are features of the work. About sixty varieties and species of vetch have been tested for two years. One of these, *Vicia dasycarpa*, is of especial promise, resembling hairy vetch, but being so early that it can be used as a winter crop in rotation with cotton. Seed is being grown in quantity. Extensive cooperative experiments with farmers, especially in the south, with common vetch and hairy vetch have been conducted during the past two years, resulting in great interest in the crop and a greatly increased culture. This work is being continued.

Tests of New Forage Crops.—Among the new forage plants under test are the Tangier pea and guar, an East Indian forage plant.